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Naval Reactors Facility

ENVIRONMENTAL SUMMARY REPORT

August 2014

Prepared for the
U.S. Department of Energy
By Bechtel Marine Propulsion Corporation
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FOR THE

NAVAL REACTORS FACILITY

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Bechtel Marine Propulsion Corporation
Bettis Atomic Power Laboratory
NAVAL REACTORS FACILITY

TABLE OF CONTENTS

Page

TABLE OF CONTENTS iv
LIST OF FIGURES v
LIST OF TABLES v
LIST OF ACRONYMS vi
1.0 SUMMARY AND CONCLUSIONS 1
1.1 Background 1
1.2 Purpose 1
1.3 Conclusions 1
2.0 NAVAL REACTORS FACILITY 3
2.1 NRF Site History 3
2.2 Significant Accomplishments 3
3.0 DESCRIPTION OF SITE 5
3.1 Site Development 5
3.2 Land Use and Demography 5
3.3 Geology and Seismology 5
3.4 Hydrology 8
3.4.1 Surface and Ground Water Sources 8
3.4.2 Surface and Ground Water Use 8
4.0 DESCRIPTION OF OPERATIONS 11
4.1 Past Operations 11
4.2 Present Operations 13
5.0 WASTE GENERATION AND CONTROLS 17
5.1 Current Waste Management Programs 17
5.1.1 Radioactive Waste Management 17
5.1.2 Non-Radioactive Waste Management 18
5.1.3 Remediation Programs. 20
5.2 Past Waste Management Practices 20
5.2.1 Past Radioactive Waste Management 20
5.2.2 Residual Radioactivity 23
5.2.3 Past Non-Radioactive Waste Management 25
5.2.4 Groundwater Monitoring 26
6.0 MONITORING PROGRAMS 29
7.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS 31
7.1 Remedial Action Areas 32
7.2 No Action Sites 32
7.3 No Further Action Sites 33
8.0 AUDITS AND REVIEWS 37
9.0 REGULATORY MATTERS 41
10.0 REFERENCES 43

LIST OF FIGURES

Figure Number	Title	Page
Figure 1	Relation of NRF to the INL	6
Figure 2	NRF Site Area Plot Plan	7
Figure 3	NRF Waste Area Group 8	34

LIST OF TABLES

Table Number	Title	Page
Table 1	NRF Waste Area Group 8 Sites	35
Table 2	Environmental Inspections/Visits of the NRF Site	38

LIST OF ACRONYMS

A1W	Large Ship Reactor Prototype
CAA	Clean Air Act
CWA	Clean Water Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCA	Consent Order and Compliance Agreement
DOE	Department of Energy
DOP	Dioctylphthalate
ECF	Expended Core Facility
EPA	Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FFCA	Federal Facility Compliance Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
HEPA	High Efficiency Particulate Air
INL	Idaho National Laboratory
IWD	Industrial Waste Ditch
mrem	Millirem
mrem/hr	Millirem per hour
NNPP	Naval Nuclear Propulsion Program
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRF	Naval Reactors Facility
OU	Operable Unit
PCBs	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
S1W	Subsequent name for the Submarine Thermal Reactor Prototype
S5G	Advanced Water Cooled Natural Circulation Submarine Prototype
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SRPA	Snake River Plain Aquifer
TSCA	Toxic Substances Control Act
USGS	United States Geological Survey
WERF	Waste Experimental Reduction Facility

1.0 SUMMARY AND CONCLUSIONS

The Idaho National Laboratory (INL), which includes the Naval Reactors Facility (NRF), is sometimes referred to as the “Site” and is owned by the United States Department of Energy (DOE) and the Naval Nuclear Propulsion Program (NNPP). NRF has been operated for the NNPP by the Bettis Atomic Power Laboratory since NRF's inception in 1949. The Bettis laboratory is a government owned facility operated by Bechtel Marine Propulsion Corporation. NRF is located on approximately 4,400 acres of land within the 572,200 acres of the INL, 54 miles west of Idaho Falls, Idaho. NRF provides the NNPP with unique capabilities for research and development of advanced naval nuclear propulsion plants.

1.1 Background

For many years, NRF and INL subcontractors have conducted environmental monitoring to demonstrate that NRF is being operated in accordance with environmental standards. The results have been published in the NRF and INL annual reports provided to federal, state, and local officials. These publicly available reports demonstrate that NRF's monitoring practices meet and are often more strict than the requirements of applicable laws and regulations. The monitoring results confirm compliance with environmental standards.

1.2 Purpose

While the annual reports describe monitoring practices and results, they do not describe the nature and environmental aspects of NRF work and facilities nor do they give a historical perspective of the Site's operations. The purpose of this report is to provide this information as well as background information, such as the geologic and hydrologic nature of the NRF Site, pertinent to understanding the environmental aspects of Site operations.

1.3 Conclusions

The following conclusions may be drawn from this report and the annual environmental monitoring results:

NRF has had environmental control programs in place since critical operations began in 1953. The objective of these programs has been to meet or exceed the requirements of laws and regulations applicable at the time. NRF's performance in radioactivity control has established and maintained levels of control that are equal to and in many cases far more stringent than applicable requirements. Radiation exposure to any member of the public due to NRF operations is very small. The maximum possible annual dose to a member of the public resulting from Site operations can only be calculated using conservative assumptions of release and human uptake. Such calculations show that the average dose is very small - approximately 0.00032 millirem (mrem). This is far less than the approximately 366 mrem received by an average individual from natural background radiation each year in southeastern Idaho, and is less than 1/1000 of the additional radiation exposure that an individual would receive from a single cross-country airplane flight.

There are isolated areas where controlled releases of low-level radioactive liquids were made prior to 1979. The total radioactivity released to the soil over the operational life of NRF is equal to the amount of naturally occurring radioactivity in the top 24 inches of native east central Idaho soil covering a local area of equal size to NRF. Members of the public cannot come in direct contact with any of the small amounts of residual radioactivity still present on the Site.

Current NRF practices for handling chemical wastes conform with applicable federal and state requirements, as confirmed by Environmental Protection Agency (EPA) and State of Idaho compliance inspections. In the past, chemical waste disposal was carried out according to industrial practices common to the time; some wastes were sent offsite for disposal and some chemicals were disposed of on the NRF Site. Consequently, some chemical residues containing heavy metals such as chromium, lead and silver are detectable in isolated areas of soil immediately adjacent to some of the chemical disposal areas. Although hazardous contaminants have been detected in these areas, the levels involved are below regulatory requirements and do not pose a threat to members of the public.

NRF operations have had no adverse effect on the groundwater of the Snake River Plain Aquifer (SRPA). Monitoring results indicate radioactivity at or near natural background levels, and no contaminants, solvents or laboratory chemicals attributable to NRF operations above National Primary Drinking Water Standards were detected. Low levels of sodium and chloride (as in table salt) used to soften the Site's water, and nitrates, possibly associated with historic industrial sewage discharges, are detectable in the immediate vicinity of NRF, at levels below the applicable drinking water standards.

Investigations of past disposal areas have been completed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Hazard Ranking Score for the NRF Site was not high enough to warrant inclusion on the EPA's National Priorities List (NPL), also known as Superfund. Nonetheless, due to the higher Hazard Ranking Scores of other facilities at the INL, the INL as a whole was placed on the NPL, and an agreement (Federal Facility Agreement and Consent Order (FFA/CO)) was entered into by the EPA, the State of Idaho, and the DOE by which INL remedial activities will be completed under EPA and state supervision. A Comprehensive Remedial Investigation and Feasibility Study (RI/FS) was completed in 1997. Based on this study, remedial actions were selected for nine sites at NRF. The EPA and Idaho Department of Health and Welfare concurred with the selected remedial actions in the Record of Decision (ROD) signed in September of 1998. Remedial action field work has been completed.

NRF's operations and environmental performance have always been subject to continuous oversight by resident representatives of the NNPP, a joint Navy/DOE organization. Periodic in-depth reviews and inspections are also conducted by personnel from NNPP headquarters.

In addition to NRF and NNPP reviews and inspections, NRF Site environmental programs are inspected by the State of Idaho and the EPA in accordance with their regulatory authority. These inspections have found Site operations to be in compliance with all applicable requirements.

In conclusion, after decades of operation, the Naval Reactors Facility has had no significant impact on the environment or adverse effect on the surrounding communities. NRF has a well-defined program in place to protect the environment, to comply with state and federal environmental requirements and interagency agreements, and to address remediation of the isolated residues from previous activities.

2.0 NAVAL REACTORS FACILITY

The Naval Reactors Facility has been operated for the Naval Nuclear Propulsion Program by the Bettis Atomic Power Laboratory since 1949. NRF is a laboratory site where prototype naval nuclear propulsion plants were tested, where Navy nuclear operators were trained, and where reactor components and naval spent fuel continue to be examined.

2.1 NRF Site History

The original mission of NRF was to demonstrate the feasibility of propelling submarines with nuclear power. In August, 1950, construction began on the Submarine Thermal Reactor Mark I, the first facility at NRF and prototype of the reactor that eventually propelled the first United States Navy nuclear powered submarine USS NAUTILUS (SSN571). Initial operation of the Submarine Thermal Reactor (later named the S1W Prototype) under nuclear power began on March 30, 1953. The S1W Prototype was used throughout its life to test advanced design equipment and new systems for current nuclear propulsion projects and obtain data for future generations of nuclear propulsion plants. After more than 36 years of operation, the S1W Prototype was defueled in 1989 and systems were placed in layup in 1990.

Following the S1W Prototype nuclear propulsion plant, two other prototype nuclear propulsion plants were constructed at NRF. The A1W Prototype, built in 1956, demonstrated the feasibility of operating two reactor plants to power one propulsion shaft. The concept was then used to power USS ENTERPRISE (CVN65), the Navy's first nuclear powered aircraft carrier. The A1W Prototype continued to test new and advanced reactors for naval applications until its shutdown in 1994. Defueling and systems lay up work was completed in 1999.

The S5G Prototype, built in 1965, was designed to demonstrate the natural circulation concept for reactor cooling ultimately used in the USS NARWHAL (SSN671) nuclear powered submarine. Similar to the A1W Prototype, the S5G Prototype was shutdown in 1995 and defueling and systems lay up was completed in 1999. The S1W, A1W and S5G Prototypes served an additional major function as training facilities for Navy nuclear propulsion plant operators.

NRF also houses the Expended Core Facility (ECF). Built in 1957 and substantially upgraded since then, this examination facility was designed to handle and examine naval nuclear spent fuel and reactor components as well as material and fuel samples irradiated in test reactors at other INL facilities. The examinations of naval spent fuel performed at ECF are critical to the design of longer-lived reactor cores, which results in the creation of less spent fuel requiring disposition. Programs at ECF which examine materials exposed to a nuclear reactor environment have provided a wealth of information for use in future naval nuclear propulsion plant designs. ECF has another related function: maintenance and repair work on NNPP radioactive material shipping containers. ECF now has the capability and equipment to load fuel modules into dry storage canisters for eventual shipment out of the State of Idaho to a permanent repository.

2.2 Significant Accomplishments

The technologies developed at the Bettis and Knolls Atomic Power Laboratories and tested at NRF are among the most valuable and sensitive military technologies in the United States. They constitute a critical element in the nation's defense system, making possible the extraordinary capabilities of United States Navy nuclear powered submarines and surface ships that today comprise about 40 percent of the Navy's combatant fleet. The S1W plant, proved with its successful simulated non-stop, submerged, full power, voyage from Newfoundland to Ireland in 1953 that reliable nuclear propulsion of submarines was feasible. The A1W plant successfully demonstrated that the power necessary to propel a major surface vessel could be attained using propulsion trains, each powered by two reactors working together. As nuclear technology advanced, the S5G prototype, housing a natural circulation reactor, was built to test a simpler and quieter reactor design achieved by eliminating the need for pumps and auxiliary equipment found in earlier pressurized water reactors. NRF continues to provide the NNPP with unique capabilities for research and development of advanced naval nuclear propulsion plants.

3.0 DESCRIPTION OF SITE

3.1 Site Development

When the Naval Ordnance Plant was built in Pocatello in 1942, the federal government set aside a large tract of desert land in the east central portion of Idaho. Designated the Naval Ordnance Testing Range, this land supported the test firing of large naval guns. When the acreage was transferred to the Atomic Energy Commission in 1949 it was renamed the National Reactor Testing Station and subsequently became the Idaho National Laboratory. The INL is a dedicated remote site for energy research and development, particularly for nuclear-related activities.

The Naval Reactors Facility was established in 1949 when a little over two acres of this testing station were cleared for the Submarine Thermal Reactor (S1W Prototype). The location of NRF within the INL is shown in Figure 1. The developed portion of the NRF Site (Figure 2) is currently 84 acres in size. NRF includes decommissioned prototype nuclear propulsion plants and the Expended Core Facility. Supplemental buildings house administrative and training functions, mechanical refurbishment and maintenance, a boiler house, temporary dry fuel storage, and warehouses.

Water for domestic purposes, fire protection, and cooling is supplied by several wells. Electric power is supplied to the Site by the Idaho Power Company. NRF also has its own sewage lagoon system on the northern perimeter. Other support services required by NRF are supplied by activities on the INL Site.

3.2 Land Use and Demography

The NRF Site is located in Butte County. The INL also includes portions of Jefferson, Bingham, Clark, and Bonneville counties.

The main population surrounding the INL lies to the east, along interstate highway I-15 and state highway 91, which run generally north and south. The two largest cities (Pocatello and Idaho Falls) are approximately 50 air miles from NRF. Most of the population is concentrated in communities to the southeast: Pocatello and Idaho Falls each with a population of approximately 60,000; and Blackfoot with 12,000. The entire area within a 50-mile radius of the INL contains a population of approximately 157,000. This information is based on the 2010 census data.

Buses are available to transport workers to and from all Site facilities located within the INL boundary. About 30 communities surrounding the INL provide personnel and services in support of INL government projects. Small farming communities are located on the west central and northwestern boundaries. Roughly 50 percent of the eastern boundary of the INL abuts agricultural land.

The INL is a major economic contributor to the southeastern Idaho economy. Approximately 6,000 people are employed at the INL, and much of the services and material consumed by INL activities are provided by local businesses.

3.3 Geology and Seismology

The INL is located in the northwestern portion of the Snake River Plain. The Snake River Plain is an U-shaped geologic feature approximately 300 miles long and 50 to 70 miles wide. Within its land area of 12,000 square miles the plain rises from an elevation of 2,300 feet in the west, near Boise, to 6,000 feet in the east, near Ashton. The plain is bounded on all sides by mountains, some topping 12,000 feet.

The Eastern Snake River Plain extends southwesterly from the northeast corner of Idaho, near Yellowstone National Park, toward the Hagerman-Twin Falls area. The Western Snake River Plain extends northwesterly to the Idaho-Oregon border from the Hagerman-Twin Falls area.

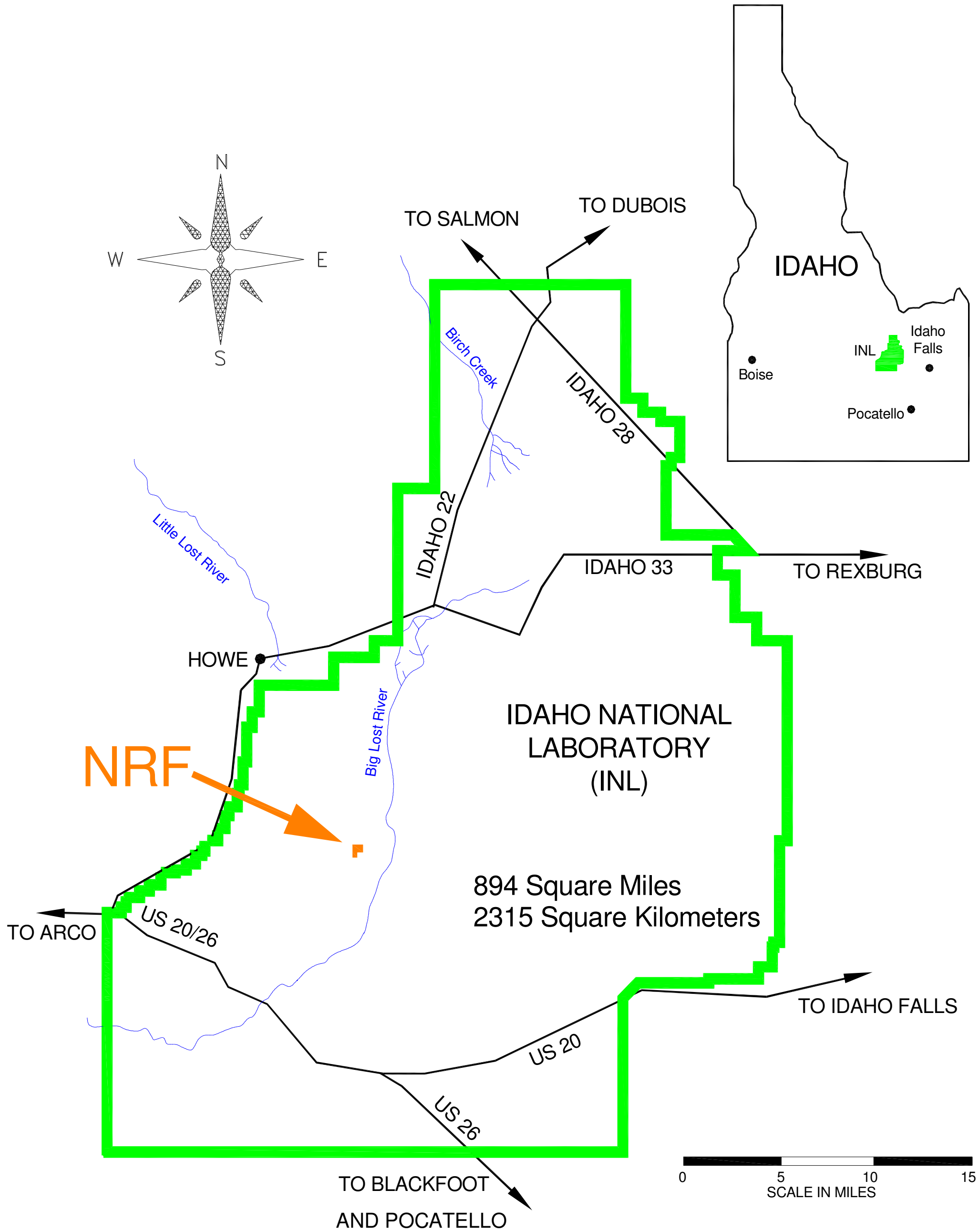

Figure 1- Relation of NRF to the INL

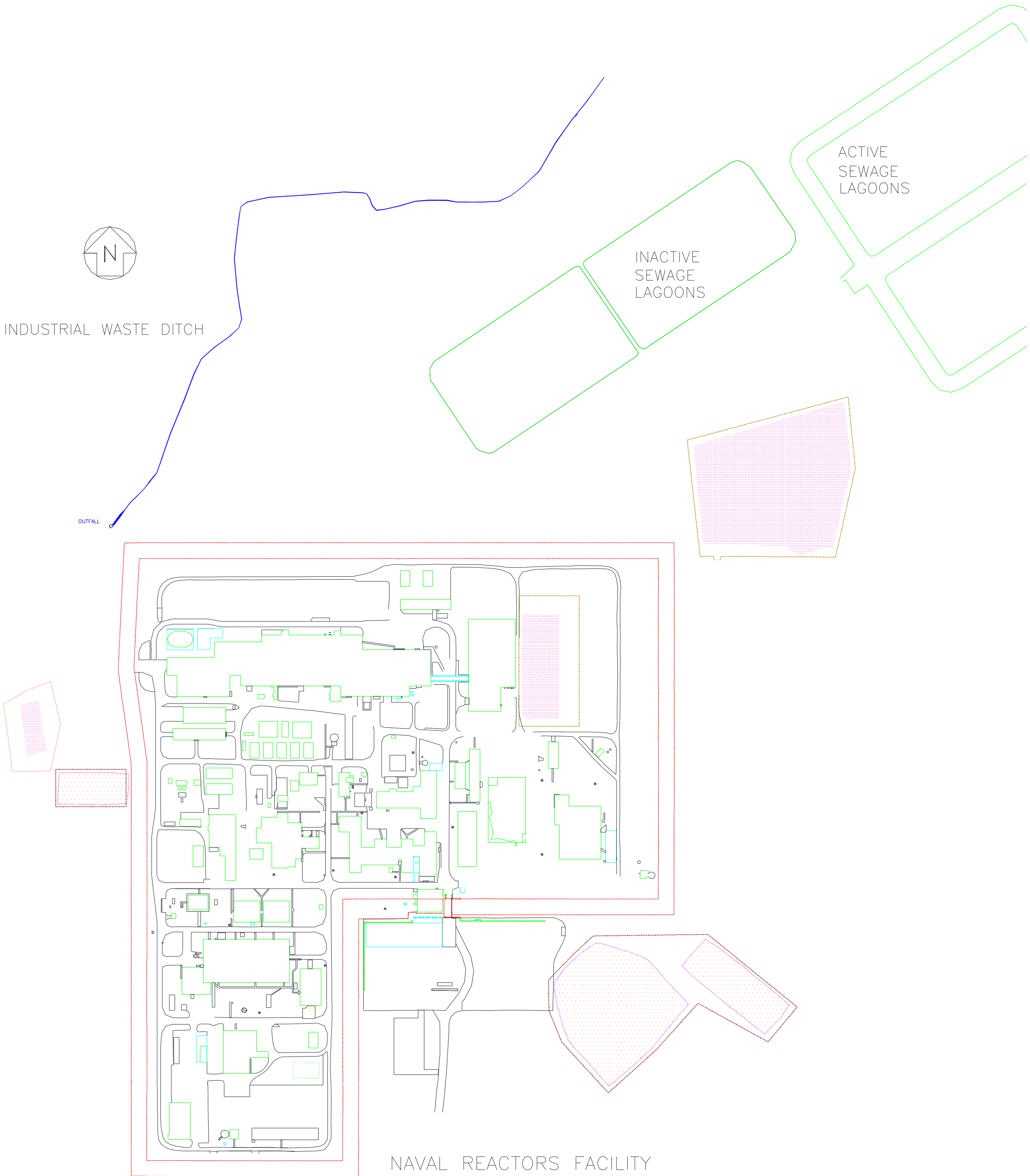

Figure 2 – NRF Site Area Plot Plan

The geological processes that produced the Snake River Plain are fairly recent by geologic standards, taking place within the last 17 million years.

Reference 1 is an excellent source for data on the plain, a large geologic feature of basaltic lava flows, which erupted from fissures and shield-type volcanoes. Although the geology of the basalt appears simple, genesis of the plain, anomalies in geophysical data, and wide variations in stratigraphy below the basalt reveal a complex geological system. Geological deposits in the Eastern Snake River Plain consist of Recent to Pleistocene (within two million years) unconsolidated windblown lake- and stream-deposited sediments overlying multiple layers of basalts and interbedded sedimentary layers. The stream and lake bed sediments are comprised primarily of sub-rounded to rounded gravels composed of all rock types represented in the adjacent mountains as well as the local basalts. Deposition of this large quantity of gravelly material appears to have resulted from sustained stream flows higher than currently exist, climatologically dating much of the sedimentation to the late Pleistocene epoch.

Ten thousand feet of basalt layers interbedded with ancient stream and lake bed sediments dampen or attenuate shock waves generated by earthquakes. Over the past one-hundred years, there have been numerous earthquakes with a magnitude of 5.5 or greater with epicenters ranging from 58 to 176 miles from NRF (Reference 2). An earthquake with a magnitude of 7.5 on the Richter Scale hit the west flank of the Madison Range some 116 miles northeast of NRF in August of 1959. The facilities at INL were shaken but not damaged. On October 28, 1983, an earthquake hit the west side of the Lost River Range with a magnitude of 7.3 on the Richter Scale. This earthquake was 58 miles west of NRF; again the Site felt the disturbance without sustaining damage.

The geology of the NRF Site is similar to that of the Eastern Snake River Plain and consists of four basic informal layers. The surface layer consists of wind deposited silts and clays interspersed with fine sand. The next layer consists of alluvial deposits that range from clean gravels with few fines to well graded gravels with a sandy matrix. The third layer occurs as discontinuous clays that fill topographic depressions in the upper-most basalt flow. Finally, the last layer is composed of a thick sequence of basalt flows interbeded with sedimentary layers.

3.4 Hydrology

3.4.1 Surface and Ground Water Sources

The closest natural surface water to NRF is the Big Lost River. This river bed lies 2.5 miles east of NRF and is dry for periods ranging from six months to five years or more. The Little Lost River flows towards the INL from the north and sinks into the ground near the INL border seven miles north of NRF.

Groundwater in the Eastern Snake River Plain is contained primarily in one major unit known as the Snake River Plain Aquifer (SRPA). The SRPA is a large groundwater resource estimated to contain more than one billion acre-feet of water, with a flow rate of 2 to 20 feet per day (Reference 3). The general direction of flow in the SRPA is from northeast to southwest. At NRF, groundwater flow is generally from north to south.

The amount of water the aquifer can produce at a given location ranges from several gallons to several million gallons per day. This range in production rates is due to variability of geologic properties in the aquifer. Recharge to the aquifer is provided by underflow from the northwest portion of the plain and by rivers that drain upland areas to the north, notably the Big and Little Lost Rivers and Birch Creek.

3.4.2 Surface and Ground Water Use

The United States Geological Survey (USGS) has investigated the hydrology of the Eastern Snake River Plain in and around the INL. The major demands for ground water in or near the

INL are agricultural irrigation and INL facility use.

NRF has six production wells (two of these wells are not currently being used) which produce sufficient water for normal operational needs plus added reserve capacity.

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4.0 DESCRIPTION OF OPERATIONS

4.1 Past Operations

Four major installations are located at NRF. These are the Submarine Prototype (S1W), the Large Ship Reactor Prototype (A1W), the Natural Circulation Submarine Prototype (S5G), and the Expended Core Facility (ECF).

S1W Prototype Plant. The Submarine Thermal Reactor, as S1W was first known, was the first prototype of a submarine nuclear reactor and the first installation at NRF. To support work on the nuclear reactor, a shielded cell, controlled water-shielded fuel handling area, and decontamination facility were constructed within the prototype structure. Use of the support facilities was drastically reduced in 1957, when the Expended Core Facility was constructed with an improved capability for work on irradiated core components.

The S1W Prototype Plant was in operation for 36 years. Extensive testing was performed on reactor core components, including a series of experiments in 1955 for studying the effects of boiling conditions in naval reactors. The tests, conducted according to preplanned procedures and under carefully controlled conditions, yielded a large amount of core performance and survivability data. In 1989, the S1W prototype was shut down and all the fuel was removed.

A1W Prototype Plant. The A1W prototype, constructed in 1958, has two nuclear reactor plants. The A1W prototype consists of a dual pressurized water reactor plant representing a portion of the propulsion spaces of a large surface ship.

A1W was originally designed with two reactors used to supply steam to one propulsion plant. In 1967, the steam system was divided so that more independent operations could be conducted with each reactor. This modification allowed either plant to operate for testing purposes while the other plant was used for the training of Navy personnel, thus utilizing both reactors to their potential. In 1994, the A1W prototype was shut down and all the fuel was removed.

S5G Prototype Plant. Construction of the S5G Prototype was initiated in 1961. This prototype is a pressurized water reactor having the capability to operate in either a forced circulation or a natural circulation flow mode, with cooling flow through the reactor generated by thermal circulation rather than pumps. In 1995, the S5G prototype was shut down and all the fuel was removed.

Expended Core Facility. Since 1957, ECF has received, examined and prepared naval fuel modules for shipment to the Idaho Nuclear Technology and Engineering Center at the INL. Shipments to this facility ceased in 2001, and current fuel modules are prepared for dry storage. ECF also specializes in the handling and examination of irradiated material samples from the INL's Advanced Test Reactor. These small-scale representations of fuel and core component designs are used to provide test information for design personnel. The tasks are accomplished in controlled water-shielded work areas. After removal from sealed shipping containers, the small samples are transferred into shielded cells for a more detailed examination.

The only non-naval fuel examined at ECF has been the reactor cores removed from the Shippingport Atomic Power Station, the nation's first civilian nuclear power station. In the mid 1950s, the Atomic Energy Commission requested the NNPP to develop Shippingport. The Bettis Atomic Power Laboratory was the prime contractor responsible for this design. In 1987, ECF examined the final Shippingport reactor core, the Light Water Breeder Reactor design, and provided measurement data which demonstrated that a reactor core fueled by uranium-233 and thorium-232 could breed more fuel than was consumed during the life of the core.

Cooling Towers and Spray Ponds. Two large spray ponds were built for cooling the S1W Prototype, each with a capacity of 2,250,000 gallons. Both spray ponds have been removed.

A1W and S5G both had cooling towers used to dissipate the heat from the secondary cooling system. During operations of these cooling systems, continuous blowdown of water at a rate of a few gallons per minute was used to control concentrations of dissolved minerals naturally present in the supply water. The blowdown water, which was not radioactive, was discharged into the NRF Industrial Waste Ditch. The A1W cooling tower has been completely removed with its concrete basin buried in its original location. The S5G cooling tower was dismantled except for the concrete basin, which is used for the storage of emergency fire fighting water.

Sewage Treatment Facilities. In 1951, a small sewage treatment plant was constructed consisting of an Imhoff Tank, sludge drying beds (Figure 3, item 21B), and an effluent drainfield (Figure 3, item 11). The drainfield was used until 1955 for combined radioactive liquid effluent and sewage effluent. In 1956, a sewage disposal basin (Figure 3, item 21A) was constructed southeast of NRF for sewage effluent. Radioactivity was inadvertently introduced into the disposal basin in 1956. This sewage disposal basin was used until 1960 when the NRF sewage lagoons (Figure 3, item 23) were constructed on the north side of NRF.

The original sewage disposal basin and associated systems have been remediated as specified in the NRF Final ROD signed by the EPA and State of Idaho in September of 1998 and as modified by an Explanation of Significant Difference signed by the EPA and State of Idaho in 2002.

In 1972, the lagoons, constructed in 1960, were expanded to present size. The sewage lagoons were in operation until 2012 when a new lagoon complex was constructed to meet the new state design standards for wastewater lagoons.

Leaching Beds. Prior to 1979, controlled releases of water containing low levels of radioactivity were made to soil beds near the A1W and S1W prototypes. The releases to these leaching beds were made in accordance with standards applicable at the time, and no member of the general public has ever received any measurable radiation exposure from the beds. The releases were discontinued in 1979 when onsite facilities for recycling water containing trace amounts of radioactivity became operational. The residual radioactivity remaining in the soil beds today cannot be reached by members of the general public, as the areas have been capped and access is controlled. Remedial actions were performed in these areas per the ROD.

Landfills. NRF maintained its own non-radioactive landfill operations until the early 1960s, when all solid wastes began to be shipped to the landfill at INL's Central Facilities Area. These landfills were typical for that era, containing garbage, construction debris, waste oil, solvents, scrap iron and asbestos. Most of the waste in the landfills was burned. NRF's first landfill was north of S1W. After this landfill was closed, one location on the west side of the facility and one large area at the northeast corner of the facility were utilized for solid waste disposal.

During the time they were used, there were no local, state or federal requirements governing such operations. Remedial corrective actions for these have been completed in accordance with the INL's CERCLA FFA/CO. The remedial actions required that landfill covers be placed over the landfills and monitored. The EPA and the State of Idaho oversaw these actions.

The remedial actions implemented at NRF under the FFA/CO were used as an example of successful application of CERCLA presumptive remedies by a December 1996 EPA directive (Reference 4).

The initial Five-Year Review for the remedial actions that were implemented for the inactive landfill areas was completed in 2001. More recent Five-Year Reviews that provided updates for the remedial actions that were implemented for the inactive landfill areas and remedial actions at other CERCLA sites were completed in 2006 and 2012 respectively. All of these reviews, through the use of annual inspections of the landfill covers placed over the inactive landfill areas and the ongoing review of groundwater and soil gas monitoring data, concluded that the landfill covers continue to be effective at containing contaminants by inhibiting infiltration of precipitation and by preventing direct contact with contaminated soils and landfill wastes.

4.2 Present Operations

The NRF Site employs engineers, scientists, and support personnel for procedure preparation activities, decontamination and demolition of obsolete facilities, and spent naval nuclear fuel and component inspection and testing. The spent fuel program is supported by the NRF Site facilities described below.

Expended Core Facility. ECF receives fuel removed from naval reactors for examination. Since naval nuclear fuel is robust in nature and designed to meet the stringent operational requirements for naval nuclear propulsion reactors in ships of war, the fuel maintains its integrity indefinitely under the less demanding conditions encountered during storage. Measurements of the corrosion rates for naval fuel designs have shown that naval spent nuclear fuel can be safely stored indefinitely wet or dry with no adverse effects to the environment. In addition to spent fuel, ECF also receives irradiated materials testing specimens for examination.

ECF is a single building about 1000 feet long and 194 feet wide, with a 59-foot High Bay running the length of the building. The High Bay contains four water pool work areas 20 to 45 feet deep designed for safe underwater disassembly, examination, and analysis of radioactive components and irradiation tests. The High Bay area enclosing the water pools and servicing areas has four large overhead cranes of 60 to 125 ton capacity.

The water pools contain 3.2 million gallons of water, which is cooled to prevent algae growth and enhance clarity. All this water is recirculated and filtered so no radioactive liquid is discharged to the environment.

ECF also contains several shielded cells for remote manipulation of radioactive materials. The shielded cells are adjacent to the High Bay area and are fully enclosed. These cells are maintained at a negative air pressure with ventilation exhausted through charcoal and high efficiency particulate air filters. The effluent downstream of the filters is monitored to confirm that emissions are very low. The cells have been refurbished and updated to improve their working capacity.

Spent Fuel Packaging Facility. The Spent Fuel Packaging Facility is presently capable of receiving spent fuel directly from the ECF water pools and from wet storage at the Idaho Nuclear Technology and Engineering Center using the Large Cell Cask. Baskets of spent fuel are loaded and seal welded into Spent Fuel Canisters. These canisters are loaded into concrete shielded overpacks, and the loaded overpacks are moved to a temporary dry storage facility.

The Spent Fuel Packaging Facility consists of three distinct facilities, the Overpack Construction and Storage Facility, the Canal Dry Processing Facility, and the South End Extension. Pathways between the facilities provide for movement of the overpacks using a combination of air pallets and crawler transport vehicles.

Overpack Construction and Storage Facility. This facility contains an area equipped with a crane and utilities necessary for constructing concrete shielded overpacks. Another portion of the facility provides for temporary storage of loaded and unloaded overpacks.

Canal Dry Processing Facility. This facility receives spent fuel directly from the ECF water pools and contains a loading station for processing the fuel into the canisters and shielded overpacks. A canal connects this facility with the ECF water pools.

South End Extension Facility. This facility receives baskets of spent fuel transported from the Canal Dry Processing Facility in a shielded container. The facility contains four processing stations located in a single pit. Two of the stations are used for unloading the casks and two are used for loading and sealing spent fuel into canisters and overpacks. The building contains a high bay with two overhead cranes.

Radioactive Waste Treatment Facilities. All radioactive water generated at NRF is collected and processed through a filtration and ion exchange system to remove particulate materials and reduce the radioactivity levels. The processed water is then reused. The system's filters and resin are disposed of as solid radioactive waste. All of the essential processing facilities for liquid and solid waste are serviced by filtered and monitored exhaust systems. All of the solid radioactive waste is disposed of in compliance with current regulations.

Chemistry Laboratories. NRF maintains a chemistry laboratory that performs chemical analyses, radiochemistry, and isotopic identification. The chemistry lab is located at A1W for the support of NRF operations, remediation work, ECF support, and environmental monitoring.

Boiler House. The first boiler house at NRF was located in S1W. A second boiler house was placed north of the machine shop. Both were replaced in 1958 by the existing boiler house north of the Administration Building. The boiler system currently in use consists of three oil fired saturated steam boilers and all necessary auxiliaries. Boiler house steam is supplied to various Site buildings for heat. Fuel oil is trucked to the facility and stored in two above ground 25,000-gallon storage tanks surrounded by concrete revetments.

Craft Support Buildings. To support planned facility maintenance, NRF has a Site services craft shop. This shop has a fully equipped machine shop capable of handling most facility components. Also located within the shop are a pipe fitting area, welding booths, sheet metal shop, rigging loft, mechanics area, carpenter shop, paint shop and small vehicle repair area.

Sewage Treatment Lagoons. In 2012, NRF began operation of a new 21-acre, dual cell, lined sanitary lagoon complex. These lagoons were installed to replace the existing clay lined lagoons that had been in operation since the 1960s. This new sewage lagoon complex is located northeast of the previous lagoons.

Warehouses. There are several different warehouses on site. Some of these are used for spare parts and general warehousing. Others are used for the storage of records, radioactively contaminated components, and by subcontractor personnel. Warehouses containing radioactive material are controlled as Radioactive Material Storage Areas.

Industrial Waste Ditch. The Industrial Waste Ditch (IWD), an evaporative-percolation type wastewater disposal system, is used to channel non-hazardous non-sewage wastewater from stormwater, snowmelt runoff, and ion exchange regeneration solutions. The IWD follows the course of two old stream beds that have been connected, straightened and deepened by dredging. The large uncovered portion of the IWD is three to ten feet wide, running approximately 3.2 miles. Because discharges to the IWD have decreased dramatically with the shutdown of the three prototype plants and the associated support equipment, water, 1 to 2 feet in depth, occupies only the first 300 yards of the uncovered portion of the IWD.

Much of the IWD is located outside the developed area of the facility and supports a wide variety of plant and animal life. Some portions of the ditch contained within the security fence include a comprehensive network of underground pipes and small uncovered surface channels. The interior network drains into a covered exterior culvert, through an environmental monitoring station vault, then outfalls to an uncovered exterior channel. Investigations have been performed on the interior and exterior portions of the ditch. These investigations were performed in accordance with the INL's CERCLA FFA/CO. No remedial action was determined to be necessary for these areas as documented in the NRF Industrial Waste Ditch and Landfill Areas ROD.

In July of 2007, the Idaho Department of Environmental Quality issued an Industrial Reuse Permit for operating the NRF IWD. This permit sets limits and conditions in regard to the type and amount of effluent that is discharged to the IWD. In 2012, NRF submitted paperwork that applied for renewal of the Industrial Reuse Permit. The permit expired on July 26, 2012; however, since all requirements associated with renewal of the permit were met prior to its expiration, NRF is authorized by the State of Idaho to operate under the old permit until the new permit is issued.

Deep Wells and Drinking Water System. NRF has six deep wells that provide water for all operations at NRF. Two of these wells are not currently being used. Five of the six wells are between 500 and 600 feet deep and one well is approximately 1,300 feet deep. Two wells (NRF-3 and NRF-14) are used for drinking water. The other two working wells (NRF-1 and NRF-4) are used primarily for Site production, cooling, lawn watering, and fire protection water. One well (NRF-2) was used until 2006 for drinking water, but is currently out of service with the intention that it could be returned to service in the future if needed. The other well (NRF-5) which is out of service, is currently being used as an observation well only.

Water for domestic use is currently processed through a water softener system which utilizes common salt (sodium chloride) to recharge the water softening resins. The use of softened water significantly reduces hard water deposits or scale build-up which extends equipment life, reduces maintenance costs, and minimizes the need to use other chemical treatments to contend with the consequences of using hard water.

Drinking water is monitored regularly and meets all State of Idaho requirements for drinking water quality.

Demineralizer Facility. Many NRF operations require the use of demineralized water which is processed from well water. Previously this process used large quantities of sulfuric acid and sodium hydroxide for regeneration of the ion exchange resin used in the demineralizers. Prior to 1985, the acid and basic reagent solutions were discharged directly to the IWD where the acid and basic reagents self-neutralized in the channel. In 1985, a facility to neutralize these solutions and monitor pH prior to discharge was put into operation, and direct discharge of demineralizer regeneration solutions to the IWD was terminated. In 1997, a new reverse osmosis water purification system was installed, eliminating the need for ion exchange resin and the resulting hazardous regeneration solutions.

Hazardous Waste Management. Hazardous waste routinely generated at NRF is held in satellite accumulation areas located at or near the point of generation in accordance with federal and state regulations. Once full, containers are transferred to a hazardous waste accumulation area for less than 90-day storage. Hazardous wastes stored in this less than 90-day area are manifested and shipped to an offsite EPA-permitted facility for treatment or disposal through the INL.

Radioactive Waste Management. NRF has temporary storage areas for the collection of radioactive wastes. Until the fall of 2008, all nonhazardous waste was sent directly to the Radioactive Waste Management Complex (RWMC). RWMC is an INL facility under the cognizance of the DOE Idaho Operations Office. Currently only remote handled waste is shipped to RWMC as they no longer accept contact handled waste. All contact handled waste is shipped to commercial facilities for recycling, volume reduction, or disposal.

Mixed Waste Management. Mixed waste generated at NRF is managed in satellite accumulation areas in accordance with federal and state regulations as described in the NRF Mixed Waste Management Plan. Full containers of mixed waste are placed in less than 90-day storage areas. Mixed wastes are manifested and shipped to an offsite EPA-permitted facility for treatment or disposal through the INL.

5.0 WASTE GENERATION AND CONTROLS

The NRF Site has never been a manufacturing facility; consequently, the total quantities of chemical and radioactive materials handled on the NRF Site have typically been small. When sufficient quantities are accumulated, scrap metals, lead-acid batteries, elemental lead, heavy metal bearing equipment, cardboard and wood are shipped offsite for recycling. NRF continues to minimize the generation of hazardous waste to the maximum extent practicable.

NRF Site remediation activities, ECF, and support facilities have generated quantities of low-level radioactive solid waste during their operations. A discussion of current and past waste management operations follows.

5.1 Current Waste Management Programs

5.1.1 Radioactive Waste Management

Liquid and solid radioactive wastes are generated and controlled by Site operations. In addition, NRF manages radioactive and chemically hazardous (mixed) waste in accordance with the NRF Mixed Waste Management Plan. The Resource Conservation and Recovery Act (RCRA) aspects of the plan were approved by the State of Idaho. NRF has maintained a vigorous radioactive waste control and minimization program for many years. The generation processes and the minimization program are described below.

Radioactive Liquid Waste. Federal regulations applicable to commercial nuclear industries permit the discharge of low-level radioactive liquids if they meet concentration standards established by the Nuclear Regulatory Commission. DOE regulations also permit similar discharges of low-level radioactive liquids. NRF has operated to a far more rigid disposal standard for many years. At the NRF Site, water used for radiological purposes is collected, processed to remove the radioactivity, and reused. No low-level radioactive liquids are discharged from NRF operations. The reuse processing systems include collection tanks and particulate filters, as well as activated carbon columns and/or mixed bed ion exchange resin columns to remove inorganics. The water is reused in operations involving radioactivity to the maximum extent practicable. The water reuse practices assure that over 99.9 percent of the gamma radioactivity contained in liquids associated with Site operations is removed and sent off for disposal. The remaining 0.1 percent is retained in the water that is reused.

Radioactive Solid Waste. Solid radioactive wastes are generated at the NRF Site as a result of operations, remediation, and maintenance activities. Included in this waste are process system filters, expended activated charcoal and resin, contaminated components, pieces of insulation, rags, sheet plastic, paper, filter paper and towels resulting from radiochemistry and radiation monitoring operations, and ventilation filters.

When practicable, solid radioactive waste is dismantled to reduce the volume that must be shipped for direct disposal. Solid radioactive wastes are packaged and shipped in accordance with requirements of the Department of Transportation. Remote handled wastes are disposed of at the RWMC, the radioactive solid waste disposal site located within the INL. Contact handled waste is disposed of through commercial waste processing venders.

Radioactive Airborne Effluents. Exhaust systems that service radiological facilities with a relatively high potential to generate airborne radionuclides are designed and operated to ensure the control of airborne radioactivity. Systems utilize high efficiency filters for the removal of particulate radioactivity from the exhaust air. Expended filters are disposed of as solid radioactive waste.

All exhaust system, high efficiency particulate air (HEPA) filters are tested in place following installation, and routinely thereafter. The procedure, called "DOP" or dioctylphthalate testing, is performed using 0.7-micron diameter dioctylphthalate aerosol particles. In accordance with federal specifications, the installed filter must exhibit an overall collection efficiency of 99.95 percent or higher to be acceptable for use.

In addition, exhaust systems from radiological facilities are sampled for radioactivity. Monitoring results are reported annually in the NRF Environmental Monitoring Report.

Radioactive Waste Minimization. NRF has also maintained a radioactive waste minimization program. The program includes work to identify and eliminate sources of waste generation. The NRF Site has maintained an essentially decreasing generation rate for radioactive wastes from prototype and ECF plant operations and maintenance during the past several years. NRF recycles, incinerates, and super-compacts radioactive materials through its waste processing venders when feasible.

5.1.2 Non-Radioactive Waste Management

Site operations produce a variety of industrial waste products including sewage effluent, chemical wastes, boiler exhaust gases and other products typical of a large laboratory facility. All such waste products are controlled in accordance with applicable federal and state laws. In addition, NRF has a hazardous waste minimization program. Each area is discussed below.

Non-Radioactive Liquid Waste. In February 2012, NRF began operation of a new 21-acre, dual cell, lined sanitary lagoon complex. This new sewage lagoon complex is located northeast of the previous lagoons. These lagoons were installed to replace the existing clay lined lagoons that had been in operation since the 1960s. This new lagoon system was constructed to meet the new state design standards for wastewater lagoons. A valve box located in the southern berm of the lagoon allows wastewater to be directed to either one or both of the cells depending upon the volume of wastewater being generated. A valve located within the equalization line which is located at the opposite end of the lagoons is used to stabilize the water level between the cells if needed. Treatment includes aerobic and anaerobic microbial digestion of sewage, along with evaporation of water.

Non-hazardous water from cooling systems, industrial boilers, process drains and storm-water runoff is routed to the Industrial Waste Ditch (IWD). The IWD is a large network of covered pipelines and uncovered channels of various sizes located within and outside the Site. In 1980, NRF eliminated discharges of water containing hazardous constituents to the IWD with the exception of acid and base solutions which self-neutralized within the ditch. Discharge of acids and bases was then eliminated in 1985 when a neutralization facility was installed, and the IWD now receives only non-hazardous, non-radioactive liquid wastes. The IWD supports a variety of plant and animal life that is attracted to the reliable water flow, a feature not otherwise available in this area of the eastern Idaho desert.

A small quantity of other waste liquids generated from other Site operations is controlled by several methods depending on the volume and nature of the waste. Methods used to assure safe disposal include (1) collection and transfer of wastes that contain hazardous materials or unusable mixtures of oils and liquids to a permitted offsite facility for reclamation, incineration, or treatment, (2) monitoring and control of chemical constituents to ensure that concentrations in effluent water comply with applicable standards, and (3) employee training in waste management requirements. Chemical wastes defined as hazardous in accordance with RCRA are managed in accordance with applicable regulations.

In the case of storage tanks containing environmentally hazardous materials, precautionary measures are taken to prevent or retain any leakage. The measures include periodic inspections, use of revetments or berms, sealing of drains, inclusion of liquid level gauges and alarms in selected tanks, and removal of underground tanks.

NRF has removed all known electrical transformers containing liquid polychlorinated biphenyls (PCBs) and disposed of them through appropriately licensed contractors. As a best management practice, light ballasts containing PCBs are currently being eliminated or replaced. In addition, samples are routinely collected on various materials prior to disposal to ensure no previously unidentified PCBs exist.

Non-Radioactive Solid Waste. Non-hazardous demolition debris and other similar material are disposed of in the INL landfill. The INL landfill is located approximately 10 miles south of NRF and is operated in accordance with State of Idaho regulations.

NRF recycles as much material as practical. Most solid metal waste is accumulated and sold to a scrap salvage vendor. In addition, aluminum beverage containers and cardboard material are collected for recycling. Scrap wood is sent to the INL Central Facilities Area landfill to be chipped and reused for mulch. No chemically hazardous wastes are sent to the landfill by NRF. Chemically hazardous solids are controlled and disposed in accordance with the requirements of RCRA.

Non-Radioactive Airborne Effluents. Combustion gases from the three Site boilers are discharged through elevated exhaust stacks at a height of 30 feet above ground level. The boilers provide steam for heating and, therefore, are in maximum use during the colder months. Regular opacity testing of emissions from the boilers confirms compliance with applicable regulations. The grade of fuel oil used in the boilers is controlled and monitored to ensure compliance with State of Idaho standards.

Other emissions from the Site are associated with backup diesel generators. The diesel generators are operated infrequently for tests and comply with State of Idaho regulations.

Non-Radioactive Waste Minimization and Pollution Prevention. NRF has a waste minimization program which requires specific actions to identify and minimize waste producing operations, compare minimization efforts year to year to demonstrate progress, and establish waste minimization goals. This is accomplished by establishment of strict procurement procedures, substitution of non-hazardous materials where practicable, and other similar measures.

Typical actions taken in recent years include:

- Recycling of lead acid batteries.
- Careful control of the use of chemicals to minimize hazardous constituents and to minimize the amount of excess chemicals that must be disposed of after completion of jobs.
- Training of employees to understand the hazards and to follow the proper controls for the potentially hazardous materials used in their jobs.
- Replacement of fluorescent light tubes with non-hazardous substitutes.
- Changing out PCB containing light ballasts with a non-PCB alternative.
- The recycling of thousands of pounds of: batteries, light bulbs, cooking oil, cardboard, chemicals, scrap metal, tires, motor oil, computers, wood, and toner cartridges.

NRF stresses environmentally sound management of wastes by the contractors selected for disposal or recycling. NRF requires that contractors' practices conform to all applicable regulations and, when practicable, use advanced disposal technology for NRF Site wastes.

NRF will continue to evaluate processes such as chemical purchases and operations, identifying ways to further reduce the generation of hazardous wastes.

5.1.3 Remediation Programs.

5.1.3.1 Remediation Under CERCLA

CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, requires all facilities to evaluate the presence of hazardous substances in former disposal areas and rank themselves according to a national system that identifies facilities requiring prompt remedial action. Federal and state agencies are responsible to review the self-evaluation and officially establish the Site ranking. Facilities with high rankings are considered for placement on a National Priorities List (NPL) for cleanup in accordance with direction from the EPA. Otherwise, sites are addressed according to requirements of the state where the site is located. NRF completed the self-evaluation and submitted the results to the EPA and State of Idaho in April 1988.

While the evaluation concluded that the NRF Site itself did not warrant inclusion in the NPL, the combined ranking with other INL facilities resulted in placement of the entire INL Site on the NPL. Accordingly, the State of Idaho, EPA, and the DOE have entered into a FFA/CO to remediate inactive waste disposal sites. NRF conducted its remedial work under this FFA/CO. The FFA/CO includes an action plan, which establishes the remediation priorities for the INL and certain enforceable deadlines.

Prior to the INL's listing on the NPL, NRF was conducting remedial actions at Solid Waste Management Units and Land Disposal Units under provisions of the INL RCRA Consent Order and Compliance Agreement (COCA). The COCA, issued by the EPA under authority of Section 3008(h) of RCRA, coordinated activities aimed at investigating and, where necessary, remediating sites to minimize potential harm to human health and the environment from past hazardous waste disposal practices at the INL. The COCA has been superseded by the FFA/CO.

5.1.3.2 Facility Deactivation

In 1984, NRF established a program to deactivate and minimize the number of facilities and areas requiring radiological controls. The program has accomplished the removal and decontamination of many radiological facilities consisting of tanks, pipelines, soil and structures.

Future activities will include removal of various additional systems and structures used to handle low-level radioactivity. Examples include tanks, piping, and ventilation ductwork.

5.2 Past Waste Management Practices

Radioactive waste management practices have evolved over the years consistent with advances in technology and changes in regulatory requirements. The NRF Site has always maintained an environmental program in accordance with the national standards in effect at the time. Many years ago, NRF took action to eliminate discharges of liquids containing even trace amounts of radioactivity. This action was not required by rule or law. It was done because it had become feasible and was consistent with the conservative engineering approach followed by the NNPP of minimizing releases of radioactivity.

Non-radioactive waste management practices evolved in a similar manner. Land burial of chemicals onsite was conducted in the 1950s and 1960s, consistent with accepted practice across the country at the time. Onsite burial of even small amounts of such materials at NRF was stopped in 1966. The NRF Site's current waste practices incorporate all controls required by applicable federal and state regulations. Each of these areas is discussed below.

5.2.1 Past Radioactive Waste Management

The NRF Site has always been involved in handling radioactive materials and in maintaining a radioactive waste management program. For example, requirements for treatment and disposal of solid and liquid wastes were provided for in the design of the operating facilities. Features such as retention tanks and evaporators for liquid waste, surface and subsurface facilities for temporary storage of waste, and air cleaning systems using high efficiency filters were incorporated into the initial design of the facilities.

Radioactive Liquid Waste. Liquid wastes were managed by a variety of methods. NRF has complied with then-existing limits for discharges of water containing low concentrations of radioactivity since the beginning of Site operations in the 1950s. Water containing low levels of radioactivity was discharged to specific, defined areas on NRF property that have been monitored and controlled. There were no natural surface waters in the desert near NRF, and no discharges were made that could have left the immediate area of the Site. Water exceeding radioactivity concentration limits was not discharged directly to the environment, but instead was processed through ion exchangers to remove as much radioactivity as practicable, or diluted to permissible levels prior to discharge. The discharge of water containing even trace amounts of radioactivity was discontinued in 1979.

Today, concentrations of radioactivity in the surface soils near the discharge beds are near background levels. Approximately 40 curies are estimated to remain in the beds, out of the 345 curies released since Site operations began. There is no evidence that the radioactivity, except tritium, has left the immediate area of the beds as confirmed by sampling performed as part of the NRF Comprehensive RI/FS. The decrease in curie content is due to steady decay of cobalt-60 and cesium-137, the major radionuclides of concern in the leaching beds, with half-lives of 5.3 and 30 years, respectively. These areas were identified for remedial actions as part of the NRF Comprehensive RI/FS and agreed to by the State of Idaho and EPA in the ROD signed in September 1998. The remedial actions for these areas consisted of placement of an engineered cover, institutional controls, and monitoring. The placements of the three engineered covers over these areas were completed in 2004 and are now under institutional controls with periodic monitoring.

Radioactive Solid Waste. Most of the radioactive waste volume generated by the NRF Site has been low-level waste. Solid wastes generated at NRF and sent to the INL waste disposal facilities were characterized as follows:

<u>Incinerable Low-Level Radioactive Waste</u> (Radiation levels less than 20 millirem per hour (mrem/hr) at the surface of each container):

- This type of waste consisted of paper and cloth wipes, protective clothing, wood and floor sweepings. The waste was collected in waste cans, packaged in boxes and sent to the Waste Experimental Reduction Facility (WERF) for incineration. The ash and residue were shipped to RWMC for disposal. Incineration of radioactive waste ceased in the fall of 2000.

<u>Compactable Low-Level Radioactive Waste</u> (Radiation levels less than 200 mrem/hr at the surface of each container):

- This included such waste as contaminated equipment, air filters, and materials that exceeded the radiation limits for incineration. The waste was packaged in polyurethane bags and transported by cargo container to WERF for compaction. The processed wastes were then shipped to RWMC for disposal. In August of 2001, compaction at WERF ceased.

<u>Size-reducible Low-Level Radioactive Waste</u> (Radiation levels less than 100 mrem/hr at contact with the item):

- This included such waste as contaminated equipment that could be segmented to reduce the volume by at least a factor of three. Until August of 2001, the waste was packaged and transported to WERF for segmentation. The processed wastes were shipped to RWMC for disposal.

Contact-Handled Non-processible Low-Level Radioactive Waste (Radiation levels less than 500 mrem/hr at one meter from the surface of the container):

- This included such waste as contaminated equipment that was not acceptable as incinerable, compactable, or size-reducible waste. The waste was packaged in boxes or drums and sent to the RWMC for disposal. In October of 2008, disposal of contact-handled waste at RWMC ceased.

Remote-Handled Low-Level Radioactive Waste (Radiation levels greater than 500 mrem/hr at the surface of each container):

- This included such waste as irradiated metallic scrap. This waste was generated in the ECF water pools and shielded cells. The irradiated metallic scrap was packaged in containers underwater using remote handling equipment. Wastes generated in the shielded cells were placed in containers while in the cells, removed to the water pools, and placed in shipping containers underwater. Specially designed shielded shipping casks were used to transport this waste by truck for burial at the RWMC. The radiation levels on all shipments in areas accessible to the general public were less than the limits imposed by the Department of Transportation for radioactive material shipments over public highways.

- NRF has also examined and tested fuel from nuclear-powered warships, the Shippingport Atomic Power Station, and specimens that were irradiated in test reactors. These examinations resulted in waste containing small amounts of irradiated fuel. The individual waste items containing irradiated fuel from NRF did not consist of entire cores or whole fuel cells, which were considered a valuable resource at the time and retained for reprocessing. Prior to 1971, about 220 kg of mostly irradiated natural uranium was disposed of at RWMC, in accordance with the radioactive waste requirements at that time. In 1971, the Atomic Energy Commission modified the requirements for low-level waste that precluded the burial at RWMC of wastes containing irradiated fuel. Accordingly, since 1971, NRF has not disposed of waste at RWMC that contains irradiated fuel.

Radioactive Airborne Effluents. Ventilation air from radiological facilities has been discharged to the atmosphere through exhaust vents and stacks. Prior to release, air with significant potential to carry radiological particulates was passed through high efficiency particulate air (HEPA) filters and monitored to ensure compliance with existing radiation protection guidelines. The filtered air exhausted from NRF radiological facilities typically has contained less particulate radioactivity than that naturally occurring in the air that was drawn into the facilities.

Monitoring of exhaust air has been accomplished through the collection and analysis of samples of the effluent. Sampling techniques used include filter papers (for particulates, activated charcoal cartridges (for iodine gas), and molecular sieve canisters (for tritium).

Overall, less than an estimated 1,100 curies of radioactivity have been released to the atmosphere during the period of 1953 through 1989, with the majority occurring in the 1950s. Most of the radioactivity (over 80 percent) consisted of the inert gaseous isotopes argon, krypton, and xenon. These inert gases do not deposit on surfaces and are readily dispersed in the atmosphere. The remainder consisted of smaller amounts of other beta-gamma emitting activated corrosion and wear products, carbon-14, and tritium and trace quantities of fission products. Since 1990 airborne emissions of radionuclides have typically been less than 2 curies per year, and annual exposure to the public from these emissions has been less than 0.001 mrem per year. For perspective, federal regulations allow up to 10 mrem per year exposure to the general public from airborne emissions from DOE facilities.

In addition to the regular annual releases, a single release occurred in 1955 during the performance of an engineering test to obtain information on the effects of boiling conditions in naval reactors. During the testing, a specially designed and instrumented test assembly was subjected to carefully controlled conditions designed to explore fuel element integrity beyond operational limits in effect at the time. Small amounts of fission products were released from the test assembly, most of which were retained in the primary coolant. A conservative estimate of the amount of radioactivity released from the Site was 870 curies. The radioactivity remaining in this coolant went to the leaching beds or purification media. The purification media was subsequently disposed of at the RWMC. Conservative calculations indicate the maximum exposure to a member of the general public was 0.5 mrem, which is only five percent of today's general public annual exposure limits from DOE facilities.

5.2.2 Residual Radioactivity

There are several localized areas of soil on NRF property that contain small amounts of residual radioactivity from historical liquid radioactivity releases. These areas were included in remedial actions as determined by the Comprehensive RI/FS and agreed to by the State of Idaho and the EPA in the ROD signed in September 1998. The specific affected areas that have undergone remedial action are discussed below:

S1W Tile Drainfield and L-shaped Sump
This area consisted of a below-surface sump and various underground, tile drain field pipes downstream of the sump. The drainfield was likely used between 1953 and 1955 for sewage and radioactive liquid discharges. The sump was isolated from the drainfield in 1955 and was used until 1960 as part of the sewage system. Sampling indicated that any significant contamination at the drainfield was likely confined to within the pipes. Remedial actions were completed in 2002.

Underground Piping to Leaching Pit. In 1955, a drainfield was constructed south of S1W, adjacent to the S1W Tile Drainfield. The drainfield was an underground, perforated pipe. This drainfield was used for radiological discharges after the S1W Tile Drainfield was no longer used. The drainfield was used for discharges until 1960. Sampling indicated most of the contamination at this drainfield was within three to five feet of the underground pipe. Contaminated soil was removed from this area. Remedial actions were completed in this area in 2003.

S1W Leaching Pit. In 1957, a pit was dug at the end of the underground, perforated pipe drainfield. This pit was known as the S1W Leaching Pit. The pit was used from 1957 until 1961 when it was filled in with soil. An asphalt cover was placed over the leaching pit location in 1978 and was removed in 2003 as part of the remedial actions. An engineered cover was constructed over this area and completed in 2004.

S1W Leaching Beds. The first S1W Leaching Bed was constructed in 1960. The bed was an open pond that allowed the water to evaporate or infiltrate into the ground. A second bed was constructed in 1963 adjacent to the first bed. The beds originally received effluent from the S1W prototype plant and later received effluent from the S5G and A1W prototypes and ECF. The beds were used from 1960 to 1979. Sampling indicated the extent of contamination in this area was primarily within the soil directly below the leaching beds. As part of remedial actions, contaminated soil from other CERCLA remedial action sites was consolidated into these beds. An engineered cover was constructed over this area and completed in 2004.

S1W Retention Basins. The S1W Retention Basins were constructed in 1951. The basins were two concrete structures, which received radioactive effluent from the S1W prototype plant and later received effluent from the S5G and A1W prototype plants and ECF. The basins were used as a radioactive liquid storage facility prior to discharging the liquid to the discharge areas. One of the basins is known to have leaked in 1971. The leak was directly below the basins. Remedial actions were completed at this area in 2001. These actions included the removal of the basins and associated contaminated soil.

A1W Leaching Bed. The A1W Leaching Bed was constructed west of NRF in 1957. The bed was not an open pond like the S1W Leaching Beds. The A1W Leaching Bed was similar to a drainfield with underground, perforated pipes distributing the liquid to an area constructed of gravel and sand. The bed was used continually from 1958 to 1964 for effluent discharges from the A1W prototype and ECF. The bed was used sporadically from 1964 until 1972, when use of the bed was discontinued. Sampling indicated that the extent of contamination at the A1W Leaching Bed was limited to the soil within and directly below the leaching bed. An engineered cover was constructed over the area and completed in 2004.

Old Sewage Basin. In 1956, a sewage basin was constructed to the southeast of NRF. The sewage basin was an open pond. The basin was cross-contaminated with the radiological discharge system in 1956. The basin was enlarged in 1957 and was used until 1960. The basin was then filled in with soil. Remedial actions began at this site in 2000. An Explanation of Significant Difference to the ROD was issued for this site in 2002 that modified remedial actions to include the construction of an engineered cover over the area. The cover was constructed over this area and completed in 2004.

Sludge Drying Bed. The sludge drying bed was constructed in 1951 as part of the sewage system at NRF. The bed was a concrete slab approximately five feet below the surrounding ground elevation. The bed received sludge from the sewage system. The bed was suspected to have been contaminated with radionuclides when the sewage system was cross-contaminated with the radiological discharge system in 1956. Remedial actions were completed at this area in 2002 with the removal of the bed and associated soil.

A1W/S1W Radioactive Line Near Butler Building 19. During the construction of A1W, a pipe was installed from the A1W prototype to the S1W Retention Basins that allowed radioactive effluents from A1W to be sent to the S1W radioactive discharge system. The pipe was buried approximately six feet below the surface. The pipe is known to have leaked on one occasion. During decontamination and dispositioning work at NRF in 1995, portions of the pipe were removed and contamination was detected in the soil. Remedial actions were completed at this site in 1999. Residual contamination was left in place in the soil. During the demolition of the adjacent S1W Spray Pond #1 the residual contamination was remediated with agency concurrence. This removal action was completed in early 2010.

Seepage Basin Pump-out Area. This site is an area that physically surrounds the sewage disposal basin and was formed when the radioactively contaminated contents of the basin were pumped out in 1958. Additional contaminated areas associated with the Seepage Basin Pump-out Area (CERCLA Site NRF-43) were found in 2009 and 2010. These areas were remediated in 2012 by the removal and disposal of soil with contamination above the CERCLA remediation goal. A minor change to the ROD was issued with concurrence by the State of Idaho and EPA that documented the remedial action.

5.2.3 Past Non-Radioactive Waste Management

NRF has used the IWD for disposal of large volumes of cooling water, and smaller volumes of water containing low concentrations of heavy metals, acids and bases, rain water, and snow-melt runoff. The acids and bases were self-neutralizing and hence rendered each other non-hazardous. The ditch functioned in compliance with applicable standards throughout its use. Other chemical wastes were disposed of by landfill, consistent with national waste management practices of the time.

Since 1980, all waste chemicals have been packaged in approved containers and disposed of through approved offsite disposal facilities. Acidic and caustic solutions from the regeneration of resin used in a deionized water facility were discharged to the IWD, where they self-neutralized until 1985 when neutralization tanks were installed and these discharges were discontinued. In 1997, a reverse osmosis system replaced the ion exchange resin for the deionized water facility thus eliminating the need for acidic and caustic solutions completely.

Under the provisions of the INL FFA/CO, inspections, site characterizations, and geological investigations have been performed on identified solid waste disposal sites. These areas include pre-existing small depressions, as well as pits created by excavation to obtain building materials. Consistent with common practices, the disposal areas were historically used for burning and disposal of ordinary refuse (cardboard, paper, and other combustible materials). Evaluations indicate that, with the exception of the low concentrations of liquids discharged to the IWD, most chemical wastes were not land disposed. Confirming evidence of this has been provided by a review of facility drawings and photographs dating from the 1950s. Characterization of these areas has shown no significant effect on the environment discovered to date, consistent with expectations. A remedial action which included the placement of covers on three landfill areas has been completed. The covers provide additional assurance of no potential future impact of these areas on the environment.

Cooling Towers and Spray Ponds. The S1W Prototype used two large spray ponds (capacity 2,250,000 gallons each) to cool its secondary water. These ponds leaked in the 1950s and 1960s, introducing small amounts of chromium corrosion inhibitor into the soil directly beneath the structure. Upon detection of small amounts of chromium in a nearby well being used to supply Site water needs, the water supply was shifted to another well and the ponds were ultimately repaired. Chromium was not used as a corrosion inhibitor in the spray ponds after 1966 and was not detected at elevated levels in this well after the repairs.

In 1997, a decision was made to demolish the S1W Spray Pond #2. Additional data was collected at Spray Pond #2 in preparation for demolishing the spray pond. Sample results showed slightly elevated amounts of chromium. The qualitative risk associated with Spray Pond #2 was determined to be low according to CERCLA guidelines. The spray pond has since been demolished and is a CERCLA No Action site.

In 2008, a decision was made to demolish the S1W Spray Pond #1. Samples were collected from this area in preparation for removing this structure. As with the S1W Spray Pond #2, sample results for the S1W Spray Pond #1 showed slightly elevated amounts of chromium. The qualitative risk associated with the S1W Spray Pond #1 also was determined to be low according to CERCLA guidelines. The S1W Spray Pond #1 was then added to the INL Action Memorandum for General Decommissioning Activities under the Idaho Cleanup Project. As such, it was demolished under a CERCLA non-time critical removal action. The spray pond was removed in 2009.

The cooling towers for A1W and S5G used a process of continuous blowdown of the supply water to control natural concentrations of solids, subsequently discharging purged water into the IWD. In the 1950s and 1960s, blowdown water from the A1W cooling tower contained chromium compounds used as corrosion inhibitors, however, the use of chromium compounds ceased after 1966. This particular chromium is nearly exclusively in the trivalent state instead of the hexavalent form. Investigations of sediment in the industrial waste ditch indicate that detectable chromium present in the sediments is not migrating, and the levels are too low to have a measurable impact on the environment.

The A1W Cooling Tower was demolished in 1995 with its basin buried in its original location. The S5G Cooling Tower was dismantled in 1997 except for the concrete basin, which is currently used for the storage of emergency fire fighting water.

5.2.4 Groundwater Monitoring

NRF manages a comprehensive groundwater monitoring program under CERCLA to determine what, if any, effects the operations at NRF have had on the quality of the groundwater. This monitoring program, which is conducted in cooperation with the USGS, indicates that NRF operations have not significantly degraded the quality of the groundwater. NRF data, in conjunction with other INL groundwater data, is also used in an independent program managed by the USGS that monitors groundwater on the INL Site. The State of Idaho INL Oversight Program co-samples NRF and other INL groundwater monitoring wells on a periodic basis to verify programmatic monitoring results.

In addition, the USGS and the State of Idaho INL Oversight Program perform independent groundwater sampling off of the INL Site to ensure that INL operations, including NRF, do not adversely impact the general public or the water quality of the SRPA. Results of these monitoring programs indicate that no hazardous constituents or significant radioactivity associated with INL operations are migrating beyond the INL Site boundary (Reference 3, 5, 6 and 7). This monitoring provides an additional confirmation that there is no adverse impact on the aquifer from NRF operations.

Based on information collected during a 1994 fitness evaluation of the wells used for groundwater monitoring in conjunction with a CERCLA ROD that defined monitoring requirements at NRF, the NRF CERCLA groundwater monitoring network was established in 1995 by constructing six new wells and eliminating seven existing wells that had been used in the pre-1995 (non-CERCLA) NRF groundwater monitoring network. In 2007, well NRF-13 was removed from the CERCLA groundwater monitoring network because of poor sample quality. In 2009, a new well (NRF-16) was constructed to replace NRF-13. Based on concurrence by the Idaho Department of Environmental Quality and EPA, well NRF-16 was added to the CERCLA monitoring network in late 2010 and wells USGS 12 and NRF-7 were removed. Of the 11 wells comprising the current CERCLA monitoring network, eight wells have been designed specifically to monitor the upper portion of the SRPA near NRF. Although the remaining three wells included in the current CERCLA groundwater monitoring network draw water from a larger portion of the aquifer (greater than 50 feet), they are used to supplement data collected from the newer wells in the current monitoring network.

Six additional wells are located within the NRF security fence. Two are classified as drinking water wells (NRF-3 and NRF-14) and are monitored to meet the requirements of the Safe Drinking Water Act (SDWA). Two are production wells (NRF-1 and NRF-4) used for the fire main system and lawn watering at NRF. The remaining two wells are not currently being used for any water production (NRF-2 and NRF-5). These six wells are not part of the CERCLA groundwater monitoring program; however, samples from NRF-3 and NRF-14 are analyzed for metals and ions and confirm that operations at NRF have had no adverse effect on the groundwater.

The 11 CERCLA groundwater wells are sampled on a routine basis for both chemical and radiological parameters. Sample results indicate that radioactivity (except that which is attributed to tritium) occurs in the groundwater at levels which are at or near natural background levels. Tritium is found at levels which slightly exceed background levels but are significantly below regulatory concerns.

In the past three years, no solvents or laboratory chemical concentrations were measured above National Primary Drinking Water Standards.

Non-hazardous sodium, chloride, magnesium, potassium, and sulfate ions are detectable at concentrations slightly above the natural background levels in the down-gradient monitoring wells. The sodium and chloride ions (a saline mixture as in table salt) are present due to the use of common water softening agents for domestic water treatment. This saline solution enters the groundwater via the non-hazardous wastewater discharges to the IWD. Chloride concentrations often exceeded secondary standards in NRF-6. The secondary standard for iron was also exceeded one time in well NRF-11. This sample was filtered to remove particulate matter and reanalyzed. Filtered sample results were below the secondary standards indicating that the iron was attributed to the sediment rather than the water. Secondary standards are non-enforceable guidelines pertaining to groundwater constituents that may cause aesthetic effects in drinking water. NRF-6 is nearest to the IWD and thus most affected by saline discharges to the ditch. The sulfate ion concentrations are below National Secondary Drinking Water Standards. There are no drinking water standards for sodium, magnesium and potassium.

In November 2011, samples for I-129 were collected from wells NRF-6, NRF-8, NRF-9, NRF-10, and NRF-11 by the United States Geological Survey. All results were several orders of magnitude below the Maximum Contaminant Level for I-129 in drinking water (1 picocurie per liter) and do not pose a threat to human health or the environment.

To summarize, all monitoring results measured in groundwater did not exceed National Primary Drinking Water Standards, confirming that NRF operations have not had a significant impact on the environment. Complete results of the chemical and radiological groundwater monitoring programs are found each year in NRF's annual Environmental Monitoring Report.

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6.0 MONITORING PROGRAMS

NRF maintains a comprehensive multimedia environmental monitoring program covering all aspects of NRF Site operations. This program has been developed to detect any environmental effects of Site operations that might occur and to demonstrate compliance with applicable federal and state environmental requirements. Data from the monitoring programs has demonstrated that operating procedures used at NRF adequately protect the environment.

The environmental monitoring program includes the routine monitoring of industrial and sanitary liquid effluents, sediment, gaseous and particulate airborne emissions, soil and vegetation, drinking water, groundwater, soil gas, and environmental radiation levels. In addition to the routine monitoring, NRF has conducted extensive special monitoring of the areas of the NRF Site potentially affected by chemical and radiological residues. Evaluation of the environmental data indicates that NRF operations continue to have no adverse effect on the environment. A detailed description of environmental monitoring program results is provided each year in NRF's annual Environmental Monitoring Report.

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7.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

With respect to radioactivity, NRF has from its beginning monitored potential sources of releases of radioactivity to the environment from the NRF Site in liquid and airborne effluents. All releases of radioactivity have been at levels typically far below limits prescribed by the appropriate federal, state and local authorities and have resulted in no measurable radiation exposure to any member of the general public.

Releases of water containing low levels of radioactivity to various disposal basins, leaching beds, and retention basins were made principally in the 1950s and 1960s. NRF discontinued this practice in 1979 and estimates the residual activity at approximately 40 curies.

NRF has employed quantitative models that conservatively estimate potential exposures. These models consider exposure pathways that include using water that has passed through the INL for drinking and irrigation, breathing the air, and eating regional animal and vegetable food. The most recent assessment shows that the average potential radiation exposure to a member of the public from NRF operations was less than 0.00032 mrem for the entire year. This is far less than the approximately 366 mrem received by an average individual from natural background radiation each year in southeastern Idaho, and much less exposure than the 3 millirem that an individual would receive from a single cross-country airplane flight.

Since operations began, NRF has also monitored non-radioactive Site effluent water and air to ensure they meet the requirements of applicable federal and state environmental standards. Results of all effluent monitoring confirm that the operation of NRF has had no significant impact on the environment. In addition, current monitoring results indicate no contaminants, solvents, or laboratory chemicals exist above National Primary Drinking Water Standards in the groundwater in the vicinity of NRF. This is confirmed by independent monitoring conducted by the USGS and the State of Idaho INL Oversight Program. Thus, NRF operations have had no significant effect on the environment, including the SRPA.

Hazard ranking calculations performed according to federal guidelines for judging the significance of chemical and radioactive residues have been conducted in accordance with federal law. These calculations indicate that the NRF Site scores below the cutoff for designation to the NPL (Superfund) of high priority sites requiring prompt action to protect public health and safety. While NRF did not qualify for listing on the NPL as an individual facility, it was included with other INL facilities in the FFA/CO and Action Plan signed in 1991.

Under the FFA/CO, 87 sites were identified at NRF for investigation to determine potential risks to human health and the environment. Thirteen of the 87 sites were evaluated prior to the FFA/CO under the COCA. The remaining 74 sites were assessed as CERCLA-type investigations. The CERCLA investigations included Track 1, Track 2, and RI/FS type investigations. A Track 1 investigation involved sites that were believed to have a low probability of risk and sufficient information available to evaluate the sites and recommend a course of action. A Track 2 investigation involved sites that did not have sufficient data available to make a decision concerning a level of risk; for these sites, collection of additional data was necessary. A RI/FS is the most extensive investigation and attempts to characterize the nature and extent of contamination, to assess risks to human health and the environment from potential exposure to contaminants, and to evaluate cleanup actions. In addition to the investigations performed for each site through a Track 1, Track 2, or RI/FS process, a comprehensive RI/FS was performed to assess the potential cumulative, or additive, effects to human health and the environment from all sites at NRF.

The NRF Final ROD signed in 1998 divided the 87 sites into three groups: sixty-three sites were determined to require no action, twelve require no further action and twelve sites required remedial action. Remedial actions have been completed at the twelve sites under two RODs signed in 1994 and 1998 by Naval Reactors, the State of Idaho, and the EPA. The original 87 sites are shown in Figure 3 and listed in Table 1.

The hazard ranking calculations, monitoring data collected, and CERCLA Five-Year Reviews performed at NRF continue to support the conclusion that NRF operations have not had a significant impact on the environment or adverse effect on the surrounding communities. NRF has a well defined program in place to protect the environment, comply with state and federal environmental requirements and interagency agreements, and address remediation of isolated residues from previous activities.

7.1 Remedial Action Areas

The Remedial Action areas included nine sites identified in the 1998 ROD and three landfill areas identified in the 1994 ROD.

Remedial Actions for the three landfill areas as documented in the 1994 ROD included constructing three covers over the landfills and conducting soil-gas and groundwater monitoring. Construction actions were completed in 1996.

The NRF Comprehensive RI/FS involved extensive sampling and risk assessment to determine appropriate remedial actions for nine sites with historical radiological releases. These remedial actions were agreed to by the State of Idaho and the EPA in the ROD signed in September 1998. Remedial actions for the nine sites identified in the 1998 ROD included excavating soil above remediation goals and consolidating the soil at the S1W Leaching Beds, demolition of concrete structures, and removal of underground piping with disposal at an INL facility, constructing three engineered covers over four of the sites, and soil moisture and groundwater monitoring. Construction and remedial activities were completed in 2004.

Institutional controls have been established at the remedial action sites. These controls include limiting soil disturbance, periodic inspections and maintenance, and land use restrictions.

In 2006 and 2012, CERCLA Five-Year Reviews were completed for the remedial action sites. The Five-Year Reviews concluded that the selected remedies for the Remedial Action areas were effective and remained protective of human health and the environment. Furthermore, data indicate that activities at NRF have not adversely affected groundwater quality.

Groundwater monitoring programs conducted by NRF, the USGS, and the State of Idaho INL Oversight Program indicate that radioactivity associated with NRF operations is consistent with natural background levels in the groundwater around the NRF Site.

Additional actions have been performed since the completion of remedial actions for both RODs. In 2010, a new site (S1W Spray Pond #1 Structure) was remediated as a Non-Time Critical Removal Action. This increased the total number of CERCLA sites at NRF to 88.

Also in 2010, residual contamination at CERCLA Site NRF-80 was removed and the site was released for unrestricted use. In 2012, residual contamination above remediation goals was removed from CERCLA Site NRF-43 under a minor change to the ROD in 2012.

7.2 No Action Sites

Based on Track 1 and Track 2 investigations and the RI/FS evaluation, a "No Action" decision was made for those sites with no source of contamination present or a source present that represents an acceptable risk for unrestricted use. This "No Action" decision means no future evaluations or follow-ups are required. A total of 64 sites have been classified as “No Action” sites. This included the 63 sites originally classified as No Action sites in the 1998 ROD and one No Further Action site (soil beneath the S1W Spray Pond Structure) that was reclassified as a No Action site in 2008.

7.3 No Further Action Sites

Based on Track 1 and Track 2 investigations and the RI/FS evaluation, a “No Further Action” decision was made for those sites with a source or potential source present, but for which an exposure route is not available under current conditions. This “No Further Action” decision means that the site will be included in a CERCLA review performed at least every five years to ensure that site conditions used to evaluate the site have not changed and to verify the effectiveness of the “No Further Action” decision. All monitoring data collected from the No Further Action sites are included in the CERCLA five-year reviews. Although no additional remedial action is required at this time, present institutional controls, such as current fencing and administrative controls on excavation, will be maintained. If site conditions change, including present institutional controls, additional sampling, monitoring, or action will be considered. Initially 12 sites were identified as “No Further Action” sites; however, this number was reduced to 11 when one was reclassified as a No Action site in 2008. In addition, four other sites were released for unrestricted use (i.e. equivalent to a No Action Site) under a minor change to the ROD. Seven remaining No Further Action sites continue to require institutional controls.

The most recent Five-Year Review for the No Further Action sites concluded that the selected remedy for these sites appears to be effective in limiting unauthorized access and excavation.

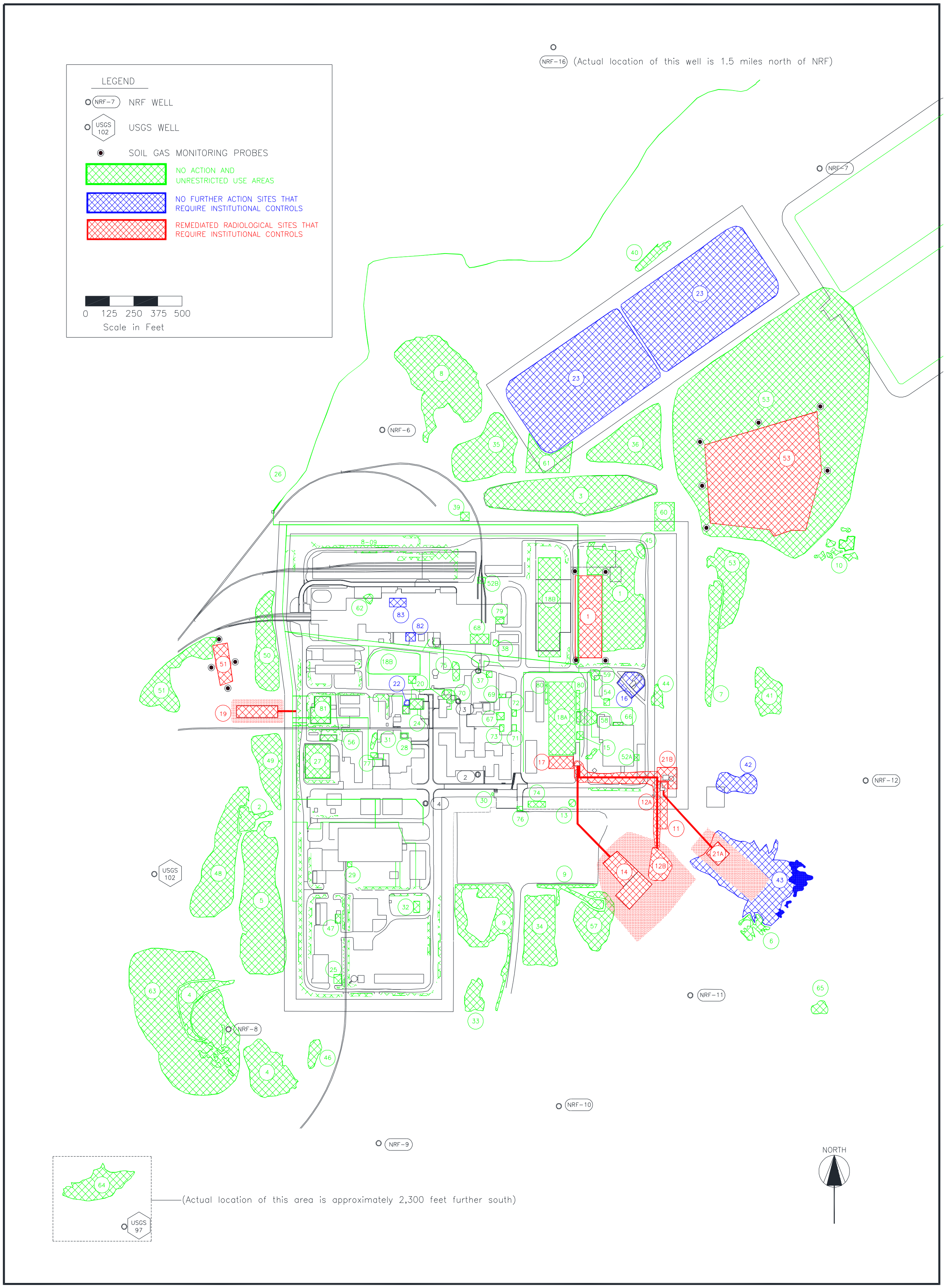

Figure 3- NRF Waste Area Group 8

Table 1- NRF Waste Area Group 8 Sites

REMEDIAL ACTION AREAS: (red)
(Requiring Institutional Controls)

NRF-1, Field Area North of S1W (capped)
NRF-11, S1W Tile Drainfield & L-shaped Sump
NRF-12A, Underground Piping to Leaching Pit
NRF-12B, S1W Leaching Pit
NRF-14, S1W Leaching Beds
NRF-17, S1W Retention Basins
NRF-19, A1W Leaching Bed
NRF-21A, Old Sewage Basin
NRF-21B, Sludge Drying Bed
NRF-51, West Refuse Pit #4 (capped)
NRF-53, East Refuse Pits & Trenching Area (capped)

NO ACTION SITES/RELEASED FOR UNRESTRICTED USE SITES: (green)

NRF-02, Old Ditch Surge Pond(1)
NRF-03, ECF Gravel Pit
NRF-04, Top Soil Pit (COCA)
NRF-05, West Landfill (COCA)
NRF-06, Southeast Landfill
NRF-07, East Landfill (COCA)
NRF-08, North Landfill
NRF-09, Parking Lot Runoff Leaching Trenches
NRF-10, Sand Blasting Slag Trench
NRF-13, S1W Temporary Leaching Pit
NRF-15, S1W Acid Spill Area
NRF-18A, S1W Spray Pond #1(2)
NRF-18B, S1W Spray Pond #2 & A1W Cooling Tower
NRF-20, A1W Acid Spill Area
NRF-24, Demineralizer & Neutralization Facility (COCA)
NRF-25, Chemical Waste Storage Pad (COCA)
NRF-26, Exterior Industrial Waste Ditch
NRF-27, Main Transformer Yard (COCA)
NRF-28, A1W Transformer Yard
NRF-29, S5G Oily Waste Spill
NRF-30, Gatehouse Transformer (COCA)
NRF-31, A1W Oily Waste Spill
NRF-32, S5G Basin Sludge Disposal Bed
NRF-33, South Landfill
NRF-34, Old Parking Lot Landfill (COCA)
NRF-35, Lagoon Landfill #1
NRF-36, Lagoon Landfill #2
NRF-37, Old Painting Booth
NRF-38, ECF French Drain
NRF-39, Old Radiography Area (COCA)
NRF-40, Lagoon Construction Rubble
NRF-41, East Rubble Area
NRF-44, S1W Industrial Wastewater Spill Area
NRF-45, Site Incinerator
NRF-46, Kerosene Spill (COCA)
NRF-47, Site Lead Shack (Building #614)
NRF-48, West Refuse Pit #1
NRF-49, West Refuse Pit #2
NRF-50, West Refuse Pit #3
NRF-52A, Old Lead Shack (Location #1)
NRF-52B, Old Lead Shack (Location #2)
NRF-54, Old Boilerhouse Blowdown Pit
NRF-55, Misc. NRF Sumps and French Drains
NRF-56, Degreasing Facility
NRF-57, S1W Gravel Pit (COCA)
NRF-58, S1W Old Fuel Oil Tank Spill
NRF-59, Original S1W Refuse Pit
NRF-60, Old Incinerator (COCA)
NRF-61, Old Radioactive Materials Storage & Laydown Area(1)
NRF-62, ECF Acid Spill Area
NRF-63, A1W Construction Debris Area
NRF-64, South Gravel Pit
NRF-65, Southeast Corner Oil Spill
NRF-66, Hot Storage Pit(1)
NRF-67, Old Transformer Yard
NRF-68, Corrosion Area Behind BB11
NRF-69, Plant Service Underground Storage Tank (UST) Diesel Spill
NRF-70, Boiler House Fuel Oil Release
NRF-71, Plant Service UST Gasoline Spill
NRF-72, NRF Waste Oil Tank
NRF-73, NRF Plant Services Varnish Tank
NRF-74, Abandoned UST's Between the NRF Security Fences
NRF-75, Fuel Oil Revetment Oil Releases
NRF-76, Vehicle Barrier Removal
NRF-77, A1W Fuel Oil Revetment Oil Releases
NRF-79, ECF Water Pool Release
NRF-80 A1W/S1W Radioactive Line Near BB19(3)
NRF-81, A1W Processing Building Area Soil(1)
OU 8-07, Interior Industrial Waste Ditch
S1W Spray Pond #1 Structure(4)

(1) No Further Action site released for unrestricted use.
(2) Soil beneath structure.
(3) Remedial Action site released for unrestrictive use.
(4) Non-Time critical removal action released for unrestricted use.

NO FURTHER ACTION SITES: (blue)
(Requiring Institutional Controls)

NRF-16, Radiography Building Collection Tanks
NRF-22, A1W Painting Locker French Drain
NRF-23, Sewage Lagoons
NRF-42, Old Sewage Effluent Ponds
NRF-43, Seepage Basin Pumpout Area
NRF-82, Evaporator Bottoms Tank Release
NRF-83, ECF Hot Cells Release Area

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8.0 AUDITS AND REVIEWS

The NRF Site uses a variety of training, controls, checks and cross-checks, audits and inspections to maintain high standards of environmental control. First, all personnel receive general awareness training. Second, each worker is trained in appropriate controls as they relate to their specific job. Third, written procedures must be followed verbatim. Fourth, dedicated technicians and supervisors oversee all environmental monitoring and related work. Fifth, NRF maintains an audit program that covers all environmental requirements and includes in-depth audits of specific areas. Sixth, the NNPP maintains an onsite resident office with a technical staff, which audits and reviews NRF environmental controls. NNPP headquarters personnel also conduct periodic in-depth inspections of these areas.

In addition, various aspects of the NRF Site environmental program are independently reviewed by other government agencies. A complete listing of inspections performed since 1992 at NRF by State of Idaho or federal agencies is outlined in Table 2. No significant item of non-compliance in operations has been cited as a result of these inspections.

Table 2 – Environmental Inspections/Visits of the NRF Site

Topic	Date	Agency
RCRA	1992 (May)	State of Idaho
Site Boiler Inspection	1993 (March)	State of Idaho
RCRA	1993 (September)	EPA (Region X) and State of Idaho
INL Oversight	1994 (July)	State of Idaho
Toxic Substances Control Act (TSCA) (PCB Records)	1994 (September)	EPA (Region X)
CAA - Title V	1994 (September)	State of Idaho
Land Application Facilities	1995 (January)	State of Idaho
TSCA (PCB)	1995 (September)	EPA (Region X)
FFA/CO	1995 (September)	State of Idaho
RI/FS	1995 (November)	EPA (Region X) and State of Idaho
Land Application Permit	1996 (March)	State of Idaho
INL Title V Air Quality Operating Permit Application	1996 (March)	State of Idaho
FFA/CO	1996 (April)	EPA (Region X)
FFA/CO	1996 (May)	State of Idaho
FFA/CO	1996 (June)	EPA (Region X)
FFA/CO	1996 (August)	EPA (Region X)
FFA/CO	1996 (August)	State of Idaho
FFA/CO	1996 (September)	EPA (Region X) and State of Idaho
FFA/CO	1997 (June)	EPA (Region X)
SDWA	1997 (July)	State of Idaho
FFA/CO	1997 (August)	State of Idaho
National Historic Preservation Act	1997 (September)	State of Idaho
FFA/CO	1998 (October)	State of Idaho
Groundwater Monitoring Audit	1999 (May)	Inspector General
Underground Storage Tanks	1999 (July)	State of Idaho and EPA National Enforcement Investigation Center
CAA	1999 (August)	State of Idaho
FFA/CO	1999 (October)	State of Idaho
FFA/CO	1999 (October)	EPA (Region X)
RCRA	2000 (April)	State of Idaho
National Historic Preservation Act	2000 (June)	State of Idaho
SDWA	2000 (June)	State of Idaho
CAA	2000 (September)	State of Idaho

Topic	Date	Agency
FFA/CO	2000 (October)	State of Idaho
INL Oversight	2000 (December)	State of Idaho
INL Oversight	2001 (June)	State of Idaho
FFA/CO	2001 (August)	State of Idaho
CAA	2002 (January)	State of Idaho
FFA/CO	2002 (May)	State of Idaho
FFA/CO	2002 (June)	State of Idaho
FFA/CO	2002 (August)	State of Idaho
FFA/CO	2002 (September)	State of Idaho
RCRA	2002 (October)	State of Idaho
CCA	2003 (January)	State of Idaho
RCRA	2003 (March)	State of Idaho
INL Oversight	2003 (April)	State of Idaho
INL Oversight	2003 (July)	State of Idaho
Backflow Testing	2003 (July)	State of Idaho
INL Oversight	2003 (September)	State of Idaho
INL Oversight	2003 (October)	State of Idaho
RCRA	2004 (May)	State of Idaho
Air Emissions	2004 (August)	EPA (Region X)
Sanitary Survey	2004 (August)	State of Idaho
INL Oversight	2004 (September)	State of Idaho
INL Oversight	2004 (September)	State of Idaho
FFA/CO	2004 (October)	State of Idaho/EPA (Region X)
Land Application Facilities	2005 (April)	State of Idaho
INL Oversight	2005 (May)	State of Idaho
INL Oversight	2005 (July)	State of Idaho
CERCLA	2005 (September)	EPA (Region X)
CERCLA	2005 (October)	State of Idaho
INL Oversight	2005 (October)	State of Idaho
RCRA	2006 (February)	State of Idaho
INL Oversight	2006 (June)	State of Idaho
Air Emissions	2006 (August)	State of Idaho
INL Oversight	2006 (October)	State of Idaho
INL Oversight	2006 (October)	State of Idaho
Wastewater Reuse Facilities	2007 (June)	State of Idaho
INL Oversight	2007 (May)	State of Idaho
FFA/CO	2008 (April)	State of Idaho/EPA (Region X)
RCRA	2008 (May)	State of Idaho
INL Oversight	2008 (May)	State of Idaho
Land Application Facilities	2008 (June)	State of Idaho

Topic	Date	Agency
RCRA	2009 (June)	State of Idaho
Wastewater Reuse Facilities	2009 (June)	State of Idaho
INL Oversight	2009 (September)	State of Idaho
Air Emissions	2009 (September)	State of Idaho
FFA/CO	2009 (November)	State of Idaho
Wastewater Reuse Facilities	2010 (September)	State of Idaho
Sanitary Survey	2010 (October)	State of Idaho
RCRA	2010 (May)	State of Idaho
INL Oversight	2010 (December)	State of Idaho
RCRA	2011 (May)	State of Idaho
CERCLA	2011 (July)	State of Idaho
Wastewater Reuse Facilities	2011 (July)	State of Idaho
Air Emissions	2011 (September)	State of Idaho
ECF Recapitalization	2011 (September)	EPA (Region X)
CERCLA	2011 (September)	State of Idaho/EPA (Region X)
Wastewater Reuse Facilities	2012 (September)	State of Idaho
Air Emissions	2012 (September)	State of Idaho
RCRA	2013 (May)	State of Idaho
Wastewater Reuse Facilities	2013 (September)	State of Idaho

9.0 REGULATORY MATTERS

NRF has always responded promptly and effectively to conform to new environmental requirements and will continue to do so. The following is a list of some of the major environmental laws that regulate NRF operations:

Resource Conservation and Recovery Act Programs (RCRA). This Act establishes requirements for the proper treatment, storage and disposal of hazardous wastes. Currently, the NRF Site operates in accordance with the applicable RCRA regulations and is a generator under the INL RCRA Permit. The INL RCRA Permit and RCRA regulations include descriptive information, identification of hazardous wastes, and waste management methods employed at NRF.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This act, commonly known as Superfund, establishes requirements for the identification and location of areas where hazardous materials have been released to the environment. NRF has prepared and submitted documentation to the EPA and the State of Idaho concerning such areas, as required by CERCLA. The submittal includes hazard-ranking scores calculated in accordance with EPA methods used to judge the significance of waste sites. The ranking calculation concludes that the NRF Site scores below the value that is used to determine whether a site warrants inclusion on the NPL. An FFA/CO (also known as an Interagency Agreement) between DOE, EPA, and the State of Idaho has been executed since the combined score of all INL facilities qualified INL for inclusion on the NPL. The FFA/CO directs all remedial action activities to be conducted in accordance with CERCLA. NRF participates in the activities outlined under the FFA/CO.

Superfund Amendments and Reauthorization Act (SARA). This act revises and extends CERCLA. CERCLA is extended by the addition of new authorities known as the Emergency Planning and Community Right-to-Know Act of 1986. This act is also known as Title III of SARA and provides for emergency planning and preparedness, community right-to-know reporting, and toxic chemical release reporting. In compliance with these requirements, NRF provides appropriate information to local emergency planning groups and regulatory agencies in a comprehensive report submitted for the INL.

Federal Facility Compliance Act (FFCA). This act requires DOE facilities to prepare plans for developing treatment capacity and technologies for sites, which generate or store mixed wastes; mixed wastes contain chemically hazardous and radioactive constituents. These plans are needed because adequate capacity for treating mixed waste to the standards required by RCRA does not currently exist. The FFCA requires Site Treatment Plans to be submitted to the regulatory state or Environmental Protection Agency for approval. As required by statute, the Idaho National Laboratory (including NRF) obtained Idaho State approval for the INL Site Treatment Plan in October of 1995.

Clean Air Act (CAA). The Clean Air Act Amendments of 1990 added the Operating Permits program to the Clean Air Act, as Title V, on November 15, 1990. The Title V Operating Permits program is implemented by the states using requirements issued by the Environmental Protection Agency. NRF participates in the INL's Title V Operating Permit Program. The State of Idaho, through the Department of Environmental Quality, issued the INL Title V Operating Permit in June of 2005. A Title V permit renewal application from the INL was declared complete by the Department of Environmental Quality on February 19, 2010. The provisions of the 2005 permit remained in effect under the permit shield until the Department of Environmental Quality issued INL a new operating permit on

February 6, 2013. Once the new permit was issued, it replaced all requirements contained in the 2005 permit.

Toxic Substances Control Act (TSCA). The U.S. Congress enacted the Toxic Substances Control Act in 1976. TSCA authorizes EPA to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. Unlike many other environmental laws, which generally govern discharge of substances, TSCA requires a review of the health and environmental effects prior to the manufacture of new chemical substance for commercial use.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The Insecticide Act of 1910 established the first federal control over the use of pesticides. In 1947 Congress enacted The Federal Insecticide, Fungicide, and Rodenticide Act which was amended several times. By 1972, this law was virtually rewritten. This statute gave EPA the authority over the field use of pesticides and requires the registration of all pesticides used in the United States. EPA restricts the application of pesticides through a state administered certification program. Only state certified commercial applicators or personnel under their supervision are allowed to apply restricted-use pesticides at NRF.

Clean Water Act (CWA). Storm water discharges to "Waters of the US" are required to be permitted by this act. The INL is covered by the National Pollutant Discharge Elimination System "NPDES" general permits for discharges of storm water associated with industrial construction activities. These permits specify storm water monitoring requirements and require Storm Water Pollution Prevention Plans, which identify best management practices used to minimize pollution of storm water runoff. Storm water from NRF does not discharge to "Waters of the US". NRF does not have a hydrologic connection to "Waters of the US" and therefore storm water does not discharge to "Waters of the US".

State of Idaho Water Quality Regulations. State of Idaho water quality regulations require industrial wastewater reuse facilities to be permitted. In July of 2007, the state issued NRF a permit for the IWD. This permit sets limits and conditions in regard to the type and amount of effluent that is discharged to the IWD. NRF has submitted an application to renew this permit and is waiting for approval from the state. NRF is authorized to operate under the old permit until a new permit is approved and issued by the state. Details of this effluent are summarized in an annual reuse report for the IWD.

Other Regulations. NRF does not anticipate any substantial future impact on Site operations from regulatory developments in other areas. However, changes in environmental regulatory requirements are continually reviewed to ensure all NRF operations remain in compliance with applicable laws, regulations and standards.

10.0 REFERENCES

1. Bonnichsen, B., and R. M. Breckenridge, eds. *Cenozoic Geology of Idaho.* Idaho Geological Survey. Bulletin 26, 1982.

2. EG&G Idaho Inc., Geosciences Unit Staff. *Naval Reactors Facility Geotechnical Investigations.* November 28, 1988.

3. Gonzales-Stoller Surveillance LLC, Environmental Surveillance, Education and Research Program, September 2013, Idaho National Laboratory, Site Environmental Report Calendar Year 2012.

4. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills.* Directive No. 9355.0-67FS, EPA/540/F-96/020, PB96-963314. December 1996.

5. Davis, L.C., Bartholomay, R. C., Rattray, G. W., 2013. An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water, Eastern Snake River Plain Aquifer and Perched Groundwater Zones , Idaho National Laboratory, Idaho, Emphasis 2009-2011: U.S. Geological Survey Scientific Investigations Report 2013-5214.

6. Rattray, G. W., and Wehnke, A. J., 2005. Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Laboratory to the Hagerman Area, Idaho, 2003: U.S. Geological Survey Open-File Report 2005-1125.

7. Bartholomay, R. C., 2013, Iodine-129 in the Snake River Plain Aquifer at and Near the Idaho National Laboratory, Idaho, 2010-12: U.S. Geological Survey Scientific Investigations Report 2013-5195 (DOE/ID-22225), 22p., http://dx.doi.org/10.3133/sir20135195.

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